

## Automotive MOSFET

## OptiMOS™ 5 Power-Transistor



## Features

- OptiMOS™ power MOSFET for automotive applications
- N-channel – Enhancement mode – Normal Level
- Extended qualification beyond AEC-Q101
- Enhanced electrical testing
- Robust design
- Linear FET (LINFET) and low  $R_{DS(on)}$  FET (ONFET) in one package
- Dedicated gate pins for both MOSFETs (Dual Gate)
- Linear FET with enhanced SOA and paralleling characteristics for linear operation
- 175°C operating temperature
- RoHS compliant
- 100% Avalanche tested
- MSL1 up to 260°C peak reflow

## Potential applications

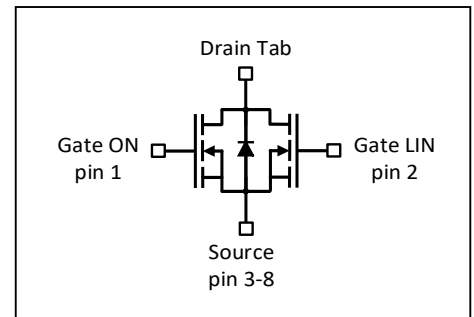
- Power distribution and battery management (electronic fuses and disconnect switches)
- In-rush current limitation (capacitor charging, motor surge current)
- Slow switching to minimize voltage transients and EMI (electrical catalyst heater)
- Drain-source voltage clamping (dissipation of inductive energy, over-voltage protection)

## Product validation

Qualified for automotive applications. Product validation according to AEC-Q101.

## Product summary

$V_{DS}$	80	V
$R_{DS(on),max}$	1.15	mΩ
$I_D$ (chip limited)	410	A



Type	Package	Marking
IAUTN08S5N012L	<a href="#">PG-HSOF-8-2</a>	5N0812L



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## Maximum ratings

 at  $T_j = 25\text{ °C}$ , unless otherwise specified

Parameter	Symbol	Conditions	Value	Unit
Drain current	$I_D$	$V_{GS,LIN} = V_{GS,ON} = 10\text{ V}$ , $T_c = 25\text{ °C}$ , chip limitation <sup>1,2)</sup>	410	A
		$V_{GS,LIN} = V_{GS,ON} = 10\text{ V}$ , $T_c = 25\text{ °C}$ , DC current <sup>3)</sup>	300	
		$V_{GS,LIN} = V_{GS,ON} = 10\text{ V}$ , $T_c = 85\text{ °C}$ , $R_{thja}$ on 2s2p <sup>2,4)</sup>	52	
Pulsed drain current	$I_{D,pulse}$	$V_{GS,LIN} = V_{GS,ON} = 10\text{ V}$ , $T_c = 25\text{ °C}$ , $t_p = 100\text{ }\mu\text{s}$ <sup>2)</sup>	1505	
Avalanche energy, single pulse <sup>2)</sup>	$E_{AS}$	$I_D = 150\text{ A}$	820	mJ
Avalanche current, single pulse	$I_{AS}$	–	300	A
Gate source voltage, LINFET	$V_{GS,LIN}$	–	$\pm 20$	V
Gate source voltage, ONFET	$V_{GS,ON}$	–	$\pm 20$	V
Power dissipation	$P_{tot}$	$T_c = 25\text{ °C}$ , $V_{GS,LIN} = V_{GS,ON} = 10\text{ V}$	375	W
Operating and storage temperature	$T_j, T_{stg}$	–	-55 ... +175	°C

## Thermal characteristics<sup>2)</sup>

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
Thermal resistance, junction - case	$R_{thJC}$	–	–	–	0.40	K/W
Thermal resistance, junction - ambient <sup>3)</sup>	$R_{thJA}$	–	–	14.8	–	

## Electrical characteristics

 at  $T_j=25\text{ °C}$ , unless otherwise specified

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
<b>Static characteristics</b>						
Drain-source breakdown voltage	$V_{(Br)DSS}$	$V_{GS,ON} = V_{GS,LIN} = 0\text{ V}$ , $I_D = 1\text{ mA}$	80	–	–	V
Current limit precision	$I_{D(lim)}$	$V_{DS} = 6\text{ V}$ , $V_{GS,ON} = 0\text{ V}$ , $V_{GS,LIN} = 5.6\text{ V}$	15	39	57	A
		$V_{DS} = 6\text{ V}$ , $V_{GS,ON} = 0\text{ V}$ , $V_{GS,LIN} = 6.2\text{ V}$	35	65	87	A
		$V_{DS} = 48\text{ V}$ , $V_{GS,ON} = 0\text{ V}$ , $V_{GS,LIN} = 5.6\text{ V}$	25	48	66	A
Gate threshold voltage	$V_{GS(th)}$	$V_{DS} = V_{GS,LIN}$ , $V_{GS,ON} = 0\text{ V}$ , $I_D = 22\text{ }\mu\text{A}$	2.5	2.9	3.3	V
		$V_{DS} = V_{GS,ON} = V_{GS,LIN}$ , $I_D = 275\text{ }\mu\text{A}$	2.5	2.9	3.3	
Zero gate voltage drain current	$I_{DSS}$	$V_{DS} = 80\text{ V}$ , $T_j = 25\text{ °C}$ , $V_{GS,ON} = V_{GS,LIN} = 0\text{ V}$	–	–	1	$\mu\text{A}$
		$V_{DS} = 50\text{ V}$ , $T_j = 85\text{ °C}$ , $V_{GS,ON} = V_{GS,LIN} = 0\text{ V}^{(2)}$	–	–	20	
Gate-source leakage current LINFET	$I_{GSS,LIN}$	$V_{GS,LIN} = 20\text{ V}$	–	–	100	nA
Gate-source leakage current ONFET	$I_{GSS,ON}$	$V_{GS,ON} = 20\text{ V}$	–	–	100	
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS,ON} = V_{GS,LIN} = 6\text{ V}$ , $I_D = 75\text{ A}$	–	1.30	1.80	m $\Omega$
		$V_{GS,ON} = V_{GS,LIN} = 10\text{ V}$ , $I_D = 100\text{ A}$	–	1.00	1.15	
		$V_{GS,ON} = 0\text{ V}$ , $V_{GS,LIN} = 6\text{ V}$ , $I_D = 3.75\text{ A}$	–	11.0	16.0	
		$V_{GS,ON} = 0\text{ V}$ , $V_{GS,LIN} = 10\text{ V}$ , $I_D = 5\text{ A}$	–	6.0	9.0	

Parameter	Symbol	Conditions	Values			Unit
			min.	typ.	max.	
<b>Dynamic characteristics<sup>2)</sup></b>						
Input capacitance ON- and LINFET	$C_{iss,ON+LIN}$	$V_{GS,ON} = V_{GS,LIN} = 0 \text{ V}$ , $V_{DS} = 40 \text{ V}$ , $f = 1 \text{ MHz}$ , refers to pins Gate ON and Gate LIN short-circuited	-	11800	15340	pF
Output capacitance ON- and LINFET	$C_{oss,ON+LIN}$		-	2100	2730	
Reverse transfer capacitance ON- and LINFET	$C_{rss,ON+LIN}$		-	91	137	
Input capacitance LINFET	$C_{iss,LIN}$	$V_{GS,ON} = V_{GS,LIN} = 0 \text{ V}$ , $V_{DS} = 40 \text{ V}$ , $f = 1 \text{ MHz}$ , refers to pin Gate LIN	-	1200	1560	
Output capacitance LINFET	$C_{oss,LIN}$		-	2100	2730	
Reverse transfer capacitance LINFET	$C_{rss,LIN}$		-	16	24	

**Gate charge characteristics<sup>2)</sup>**

Gate to source charge ON- and LINFET	$Q_{gs,ON+LIN}$	$V_{DD} = 40 \text{ V}$ , $I_D = 100 \text{ A}$ , $V_{GS,ON} = V_{GS,LIN} = 0 \text{ to } 10 \text{ V}$	-	51	66	nC
Gate to drain charge ON- and LINFET	$Q_{gd,ON+LIN}$		-	44	66	
Gate charge total ON- and LINFET	$Q_{g,ON+LIN}$		-	178	231	
Gate to source charge LINFET	$Q_{gs,LIN}$	$V_{DD} = 40 \text{ V}$ , $I_D = 5 \text{ A}$ , $V_{GS,LIN} = 0 \text{ to } 10 \text{ V}$ , $V_{GS,ON} = 0 \text{ V}$	-	5.2	6.8	
Gate to drain charge LINFET	$Q_{gd,LIN}$		-	4.7	7.1	
Gate charge total LINFET	$Q_{g,LIN}$		-	19	24	

**Reverse diode**

Diode continuous forward current <sup>2)</sup>	$I_S$	$T_C = 25 \text{ }^\circ\text{C}$	-	-	300	A
Diode pulse current <sup>2)</sup>	$I_{S,pulse}$	$T_C = 25 \text{ }^\circ\text{C}$ , $t_p = 100 \text{ } \mu\text{s}$	-	-	1505	
Diode forward voltage	$V_{SD}$	$I_F = 100 \text{ A}$ , $T_j = 25 \text{ }^\circ\text{C}$	-	0.8	1.1	V
Reverse recovery time <sup>2)</sup>	$t_{rr}$	$V_R = 40 \text{ V}$ , $I_F = 50 \text{ A}$ , $di_F/dt = 100 \text{ A}/\mu\text{s}$	-	86	-	ns
Reverse recovery charge <sup>2)</sup>	$Q_{rr}$		-	177	-	nC

<sup>1)</sup> Current is limited by the overall system design and the customer-specific PCB.

<sup>2)</sup> The parameter is not subject to production testing – specified by design.

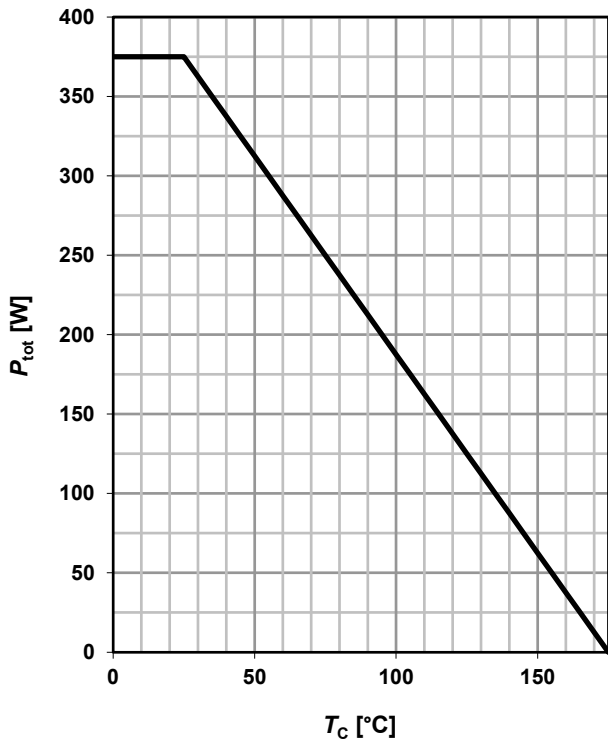
<sup>3)</sup> Current is limited by the bond wires.

<sup>4)</sup> Device on 2s2p FR4 PCB defined in accordance with JEDEC standards (JESD51-5, -7). PCB is vertical in still air.

## Electrical characteristics diagrams

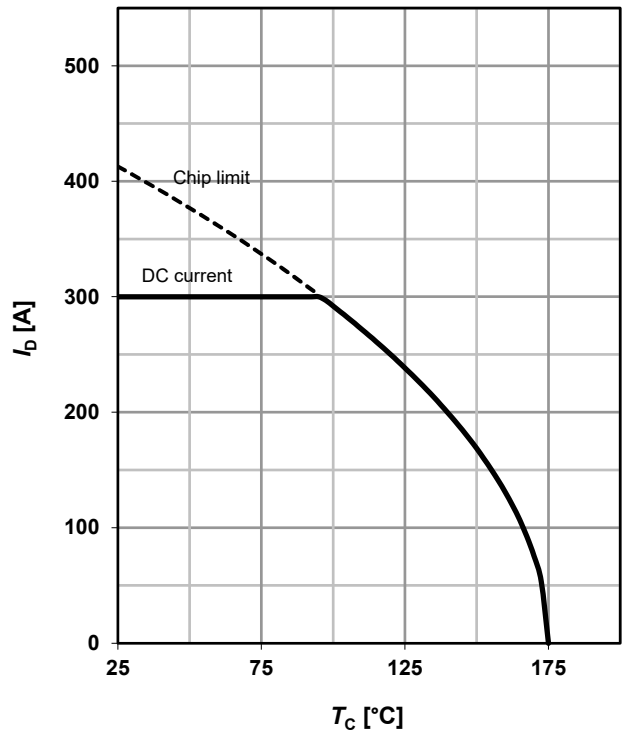
### 1 Power dissipation

$$P_{\text{tot}} = f(T_C); V_{\text{GS,ON}} = V_{\text{GS,LIN}} \geq 6 \text{ V}$$



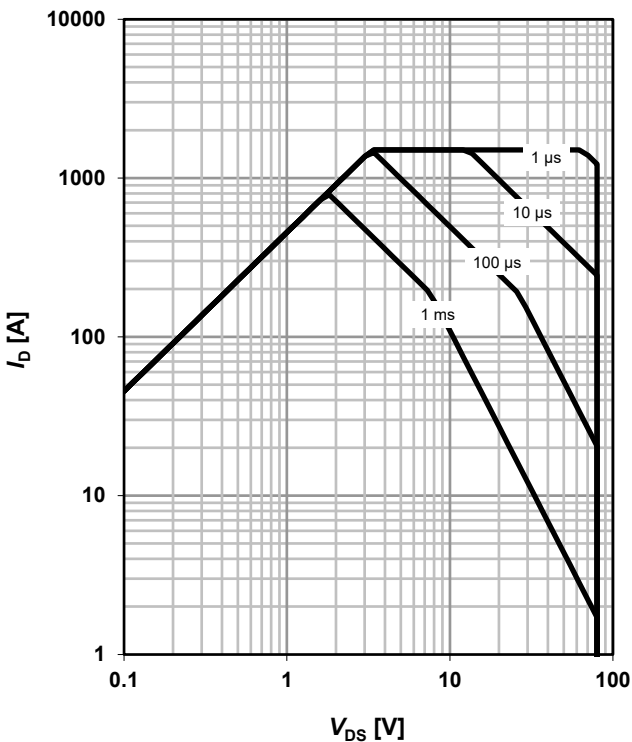
### 2 Drain current

$$I_D = f(T_C); V_{\text{GS,ON}} = V_{\text{GS,LIN}} \geq 6 \text{ V}$$



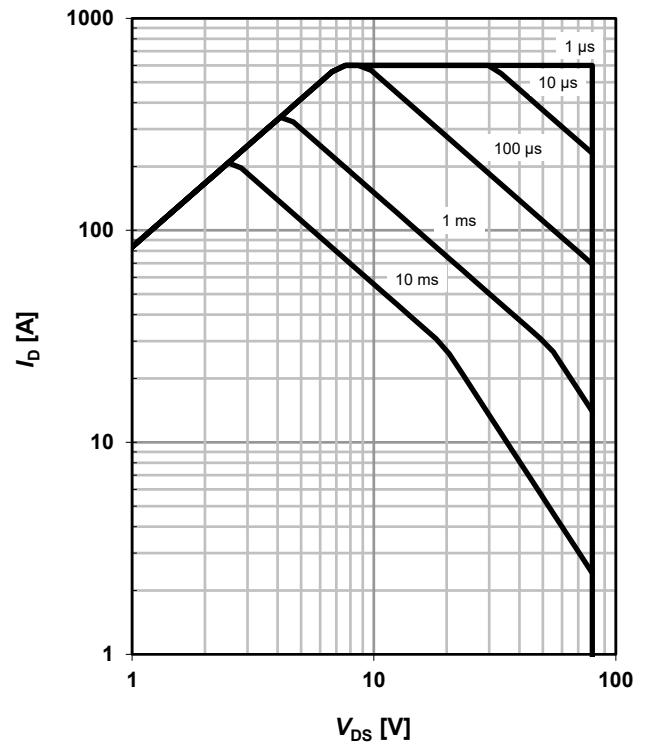
### 3 Safe operating area ONFET and LINFET

$$I_D = f(V_{\text{DS}}); T_C = 25 \text{ °C}; V_{\text{GS,LIN}} = V_{\text{GS,ON}}; D = 0; \text{parameter: } t_p$$

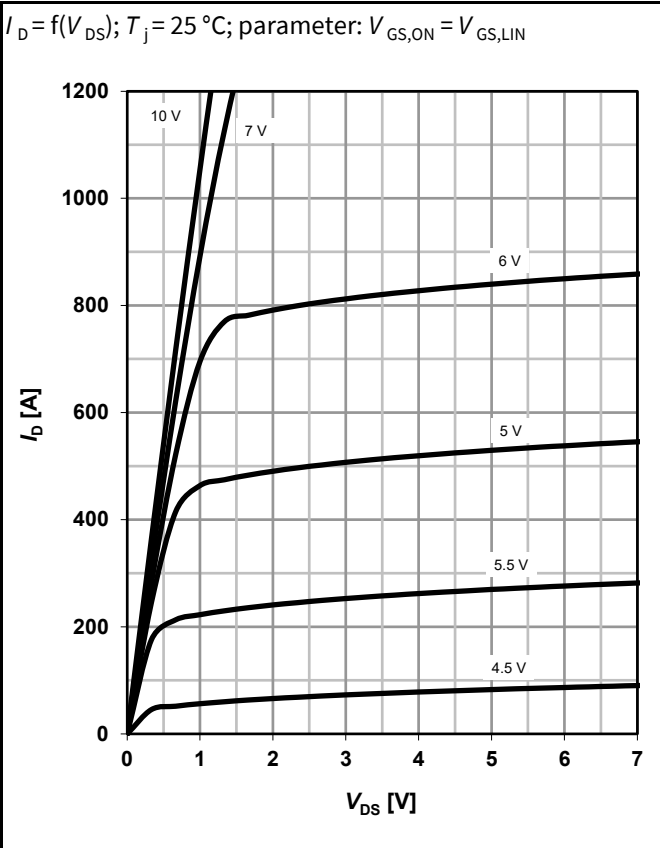


### 4 Safe operating area LINFET

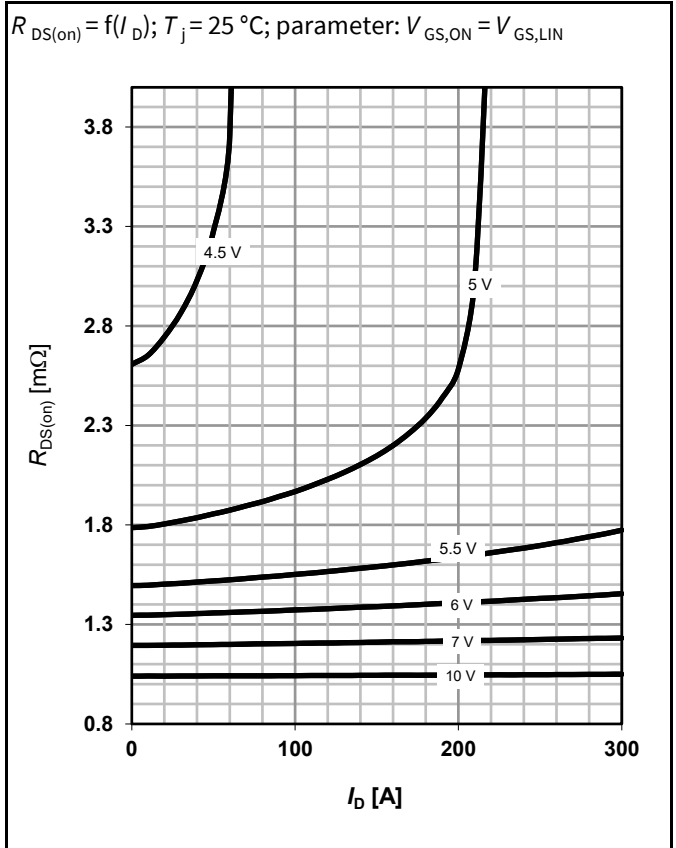
$$I_D = f(V_{\text{DS}}); T_C = 25 \text{ °C}; V_{\text{GS,ON}} = 0 \text{ V}; D = 0; \text{parameter: } t_p$$



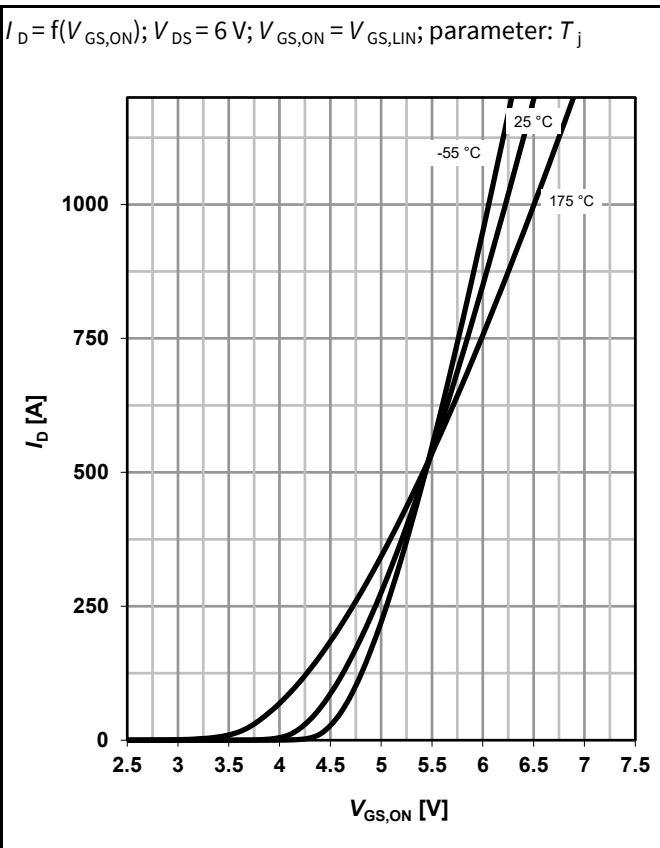
5 Typ. output characteristics ONFET and LINFET



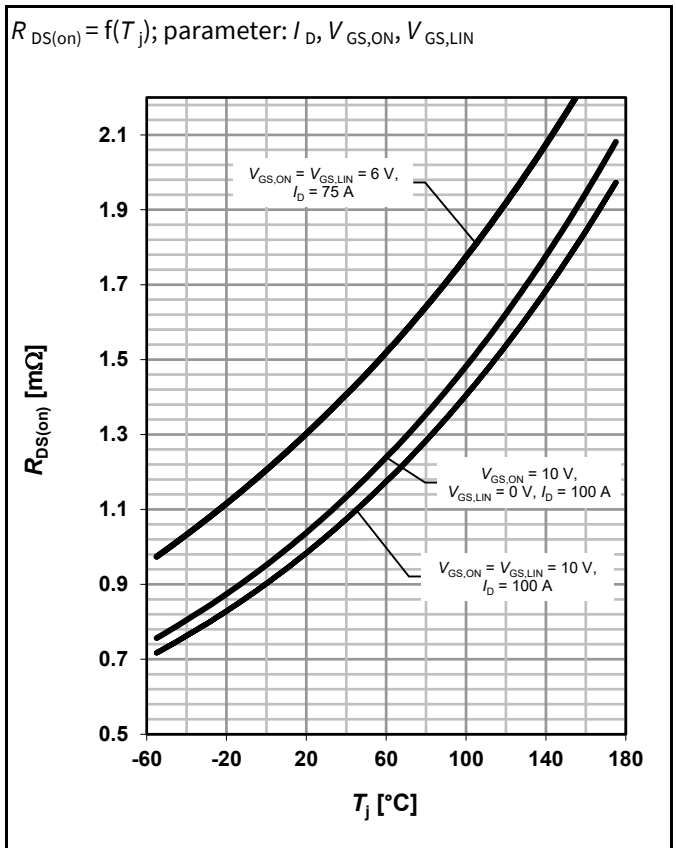
6 Typ. drain-source on-state resistance ONFET and LINFET



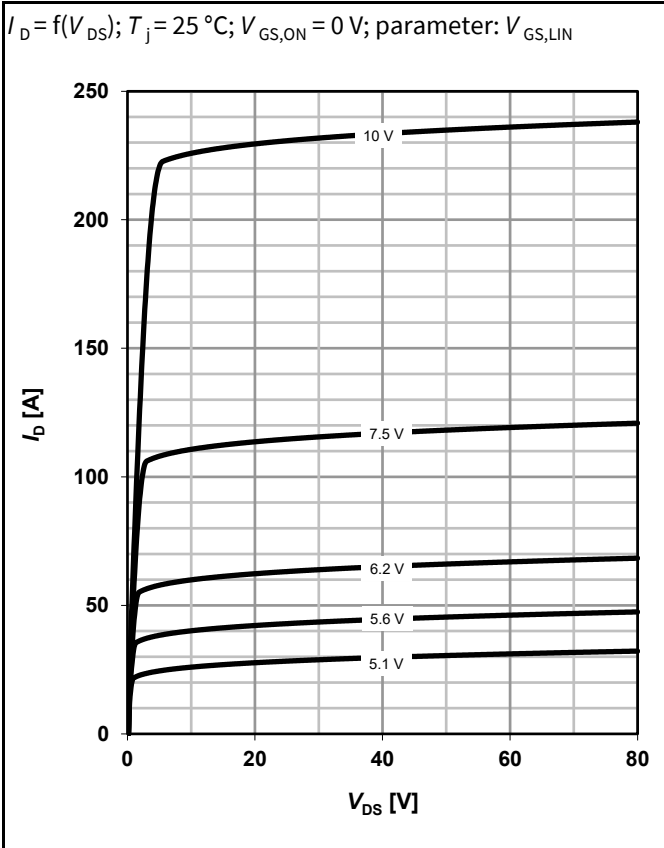
7 Typ. transfer characteristics ONFET and LINFET



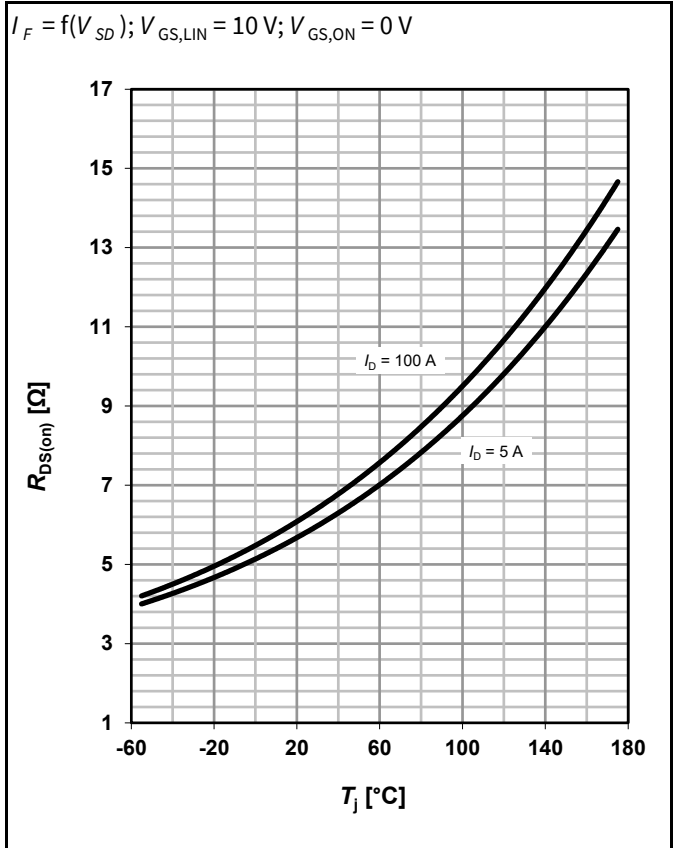
8 Typ. drain-source on-state resistance ONFET and LINFET



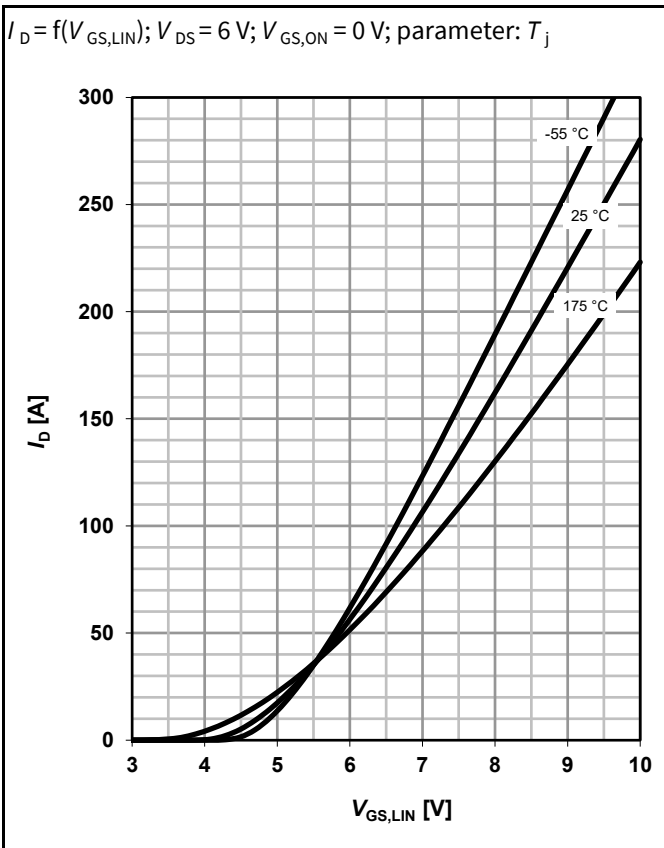
9 Typ. output characteristics LINFET



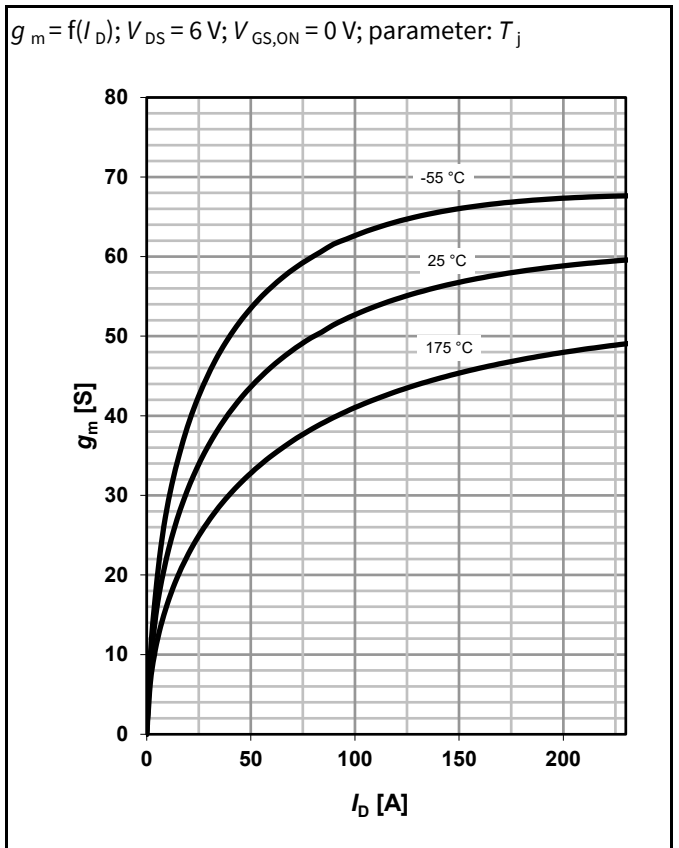
10 Typ. drain-source on-state resistance LINFET



11 Typ. transfer characteristics LINFET

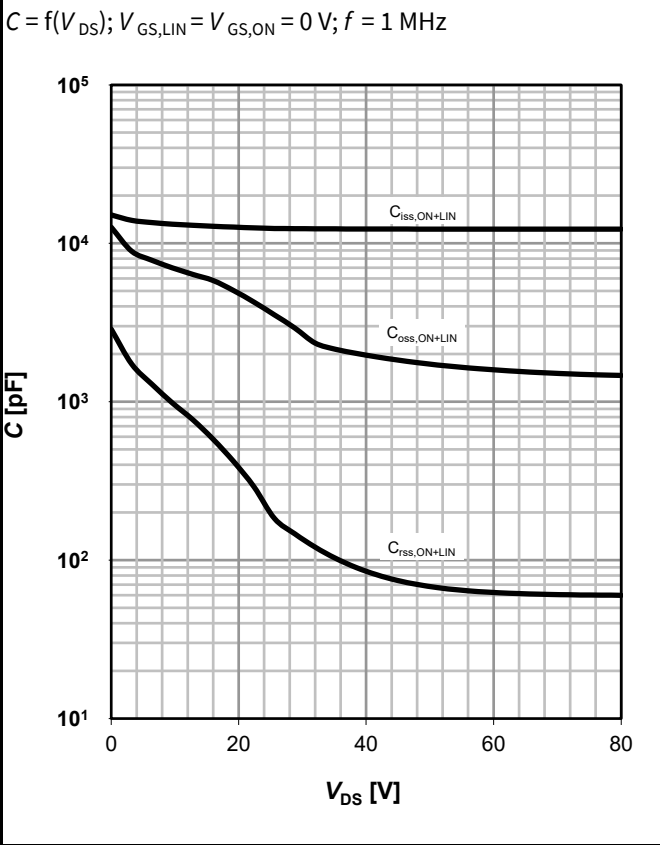


12 Typ. transconductance LINFET

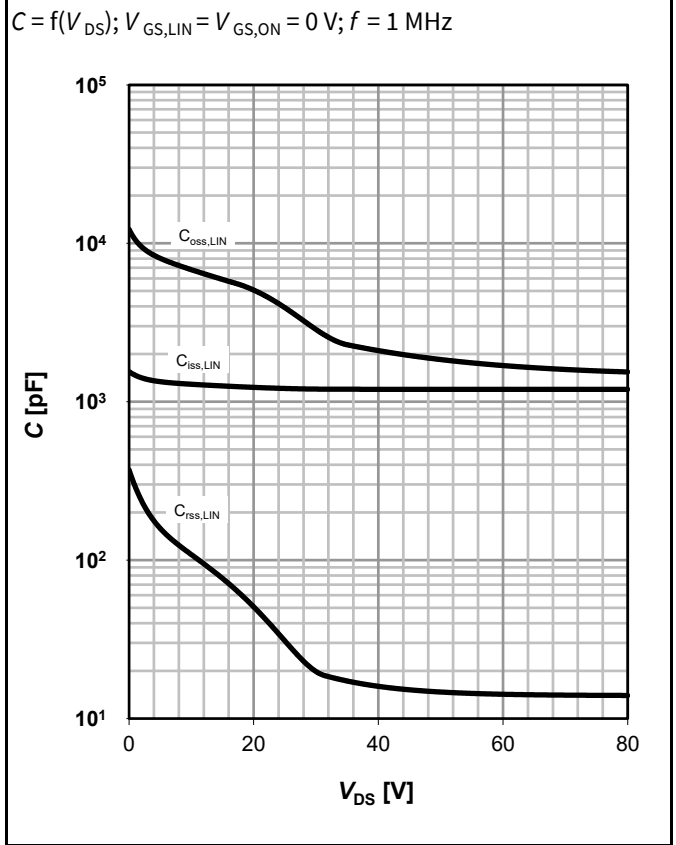




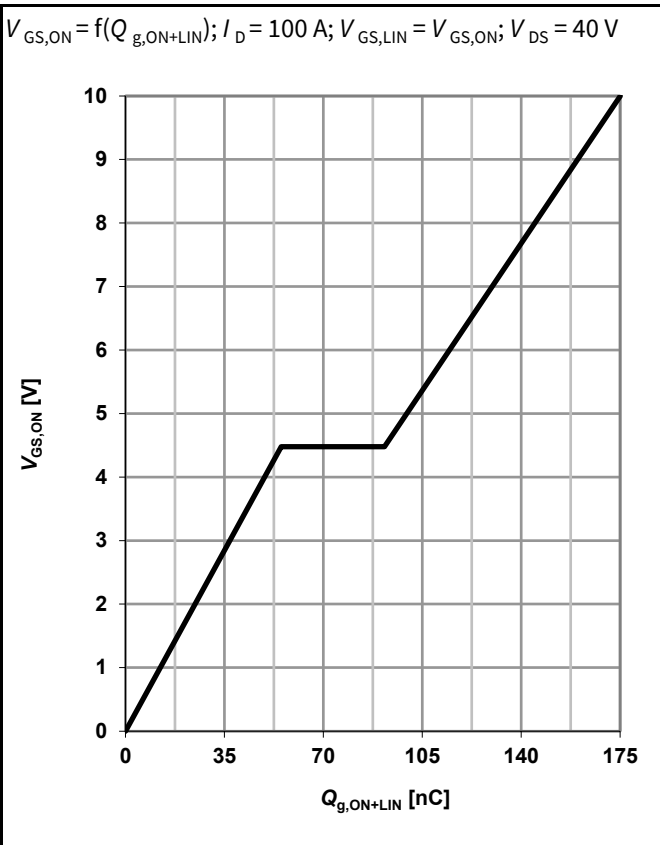
13 Typ. capacitances ONFET and LINFET



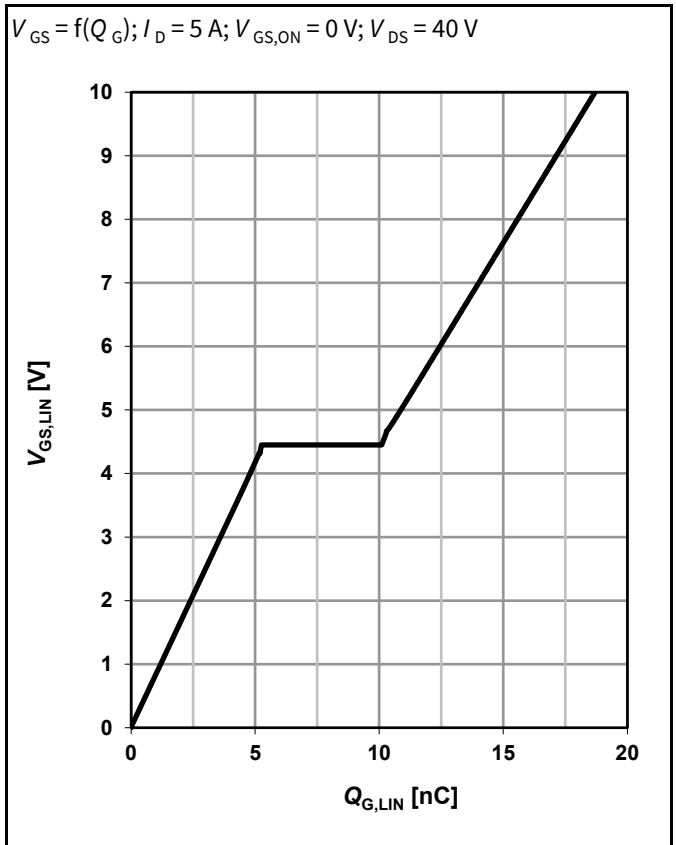
14 Typ. capacitances LINFET



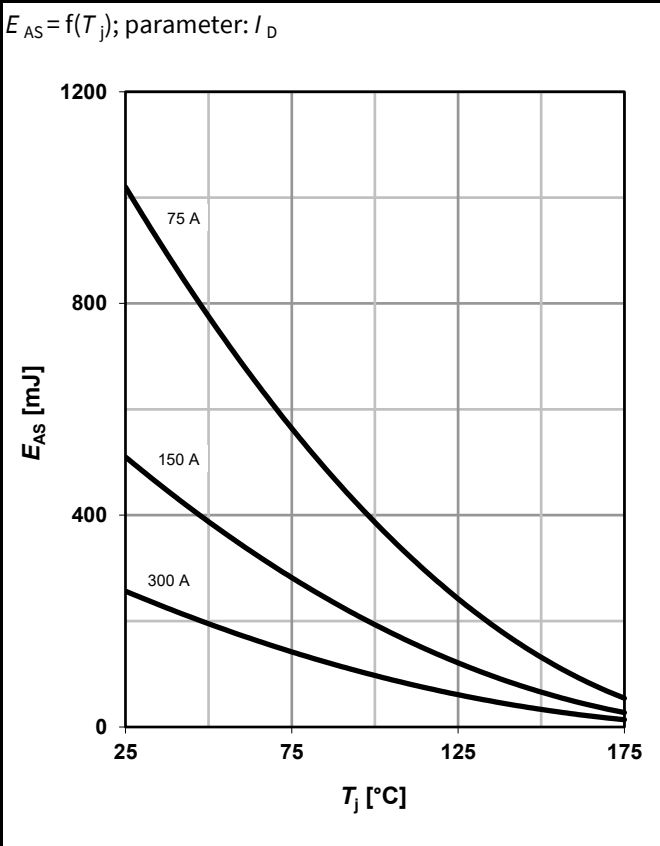
15 Typ. gate charge ONFET and LINFET



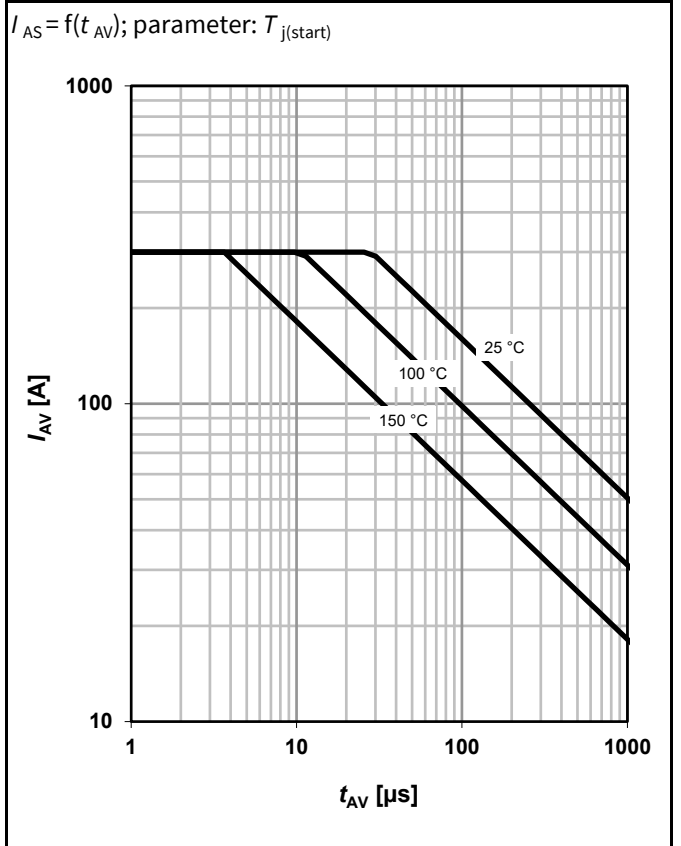
16 Typ. gate charge LINFET



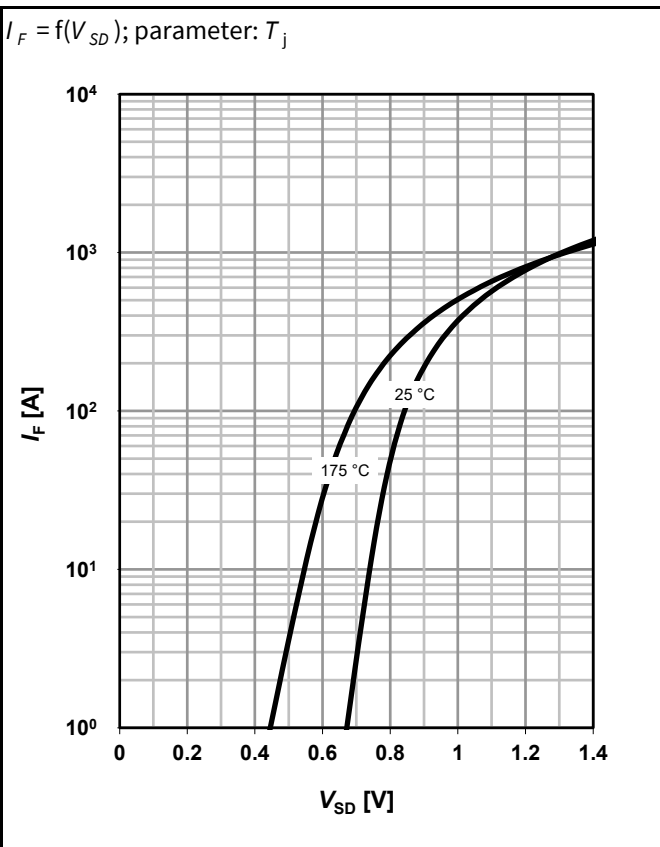
17 Typical avalanche energy



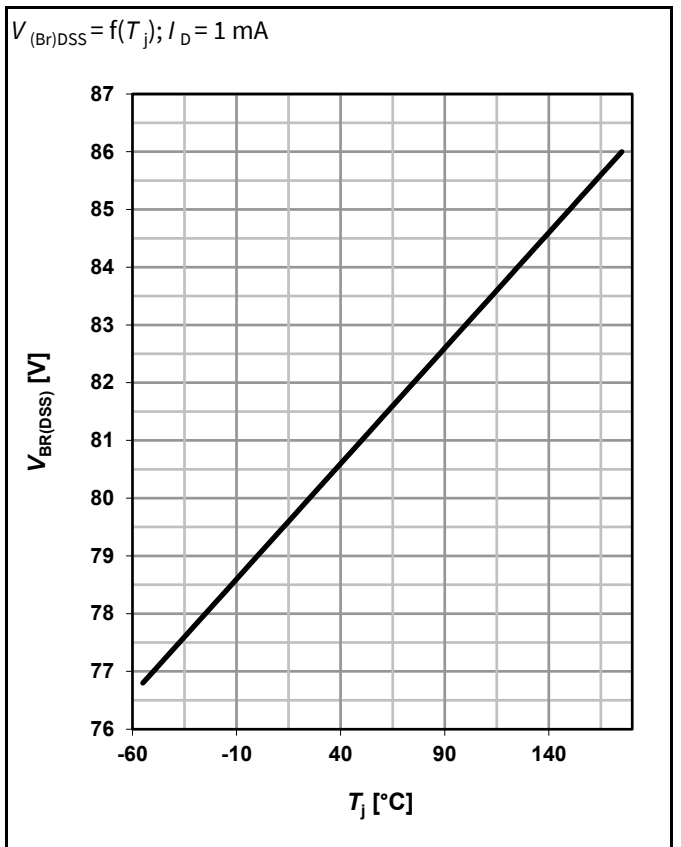
18 Typ. avalanche characteristics



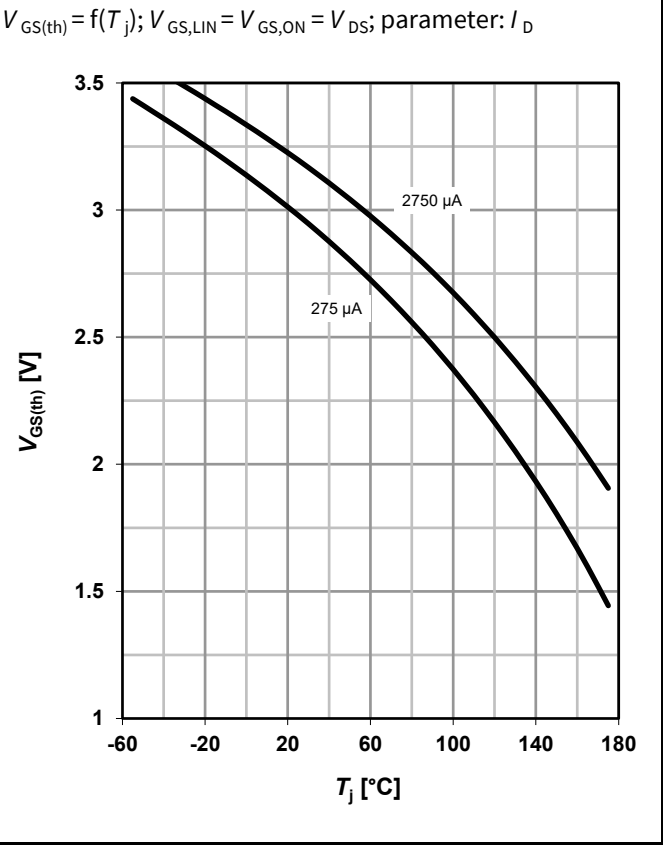
19 Typical forward diode characteristics



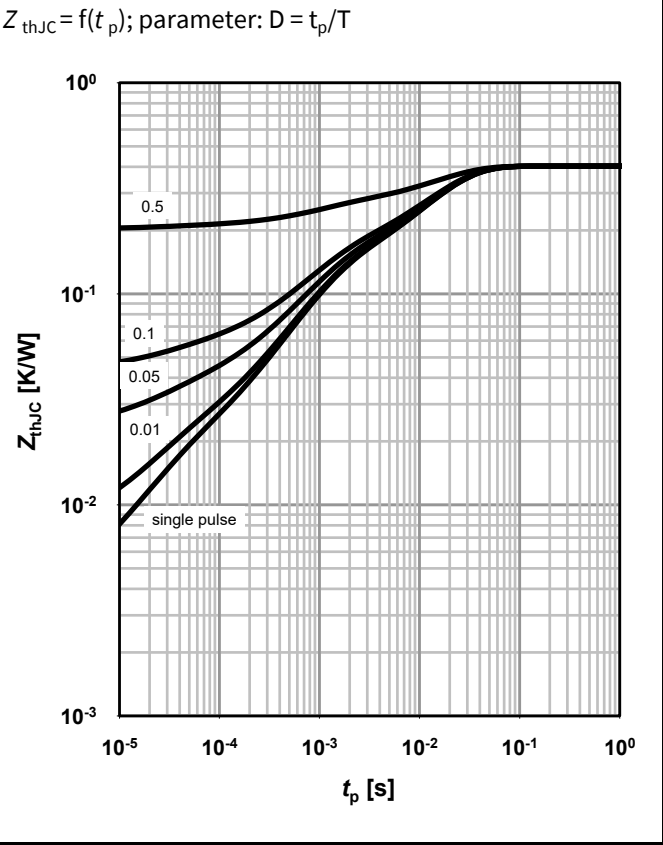
20 Drain-source breakdown voltage



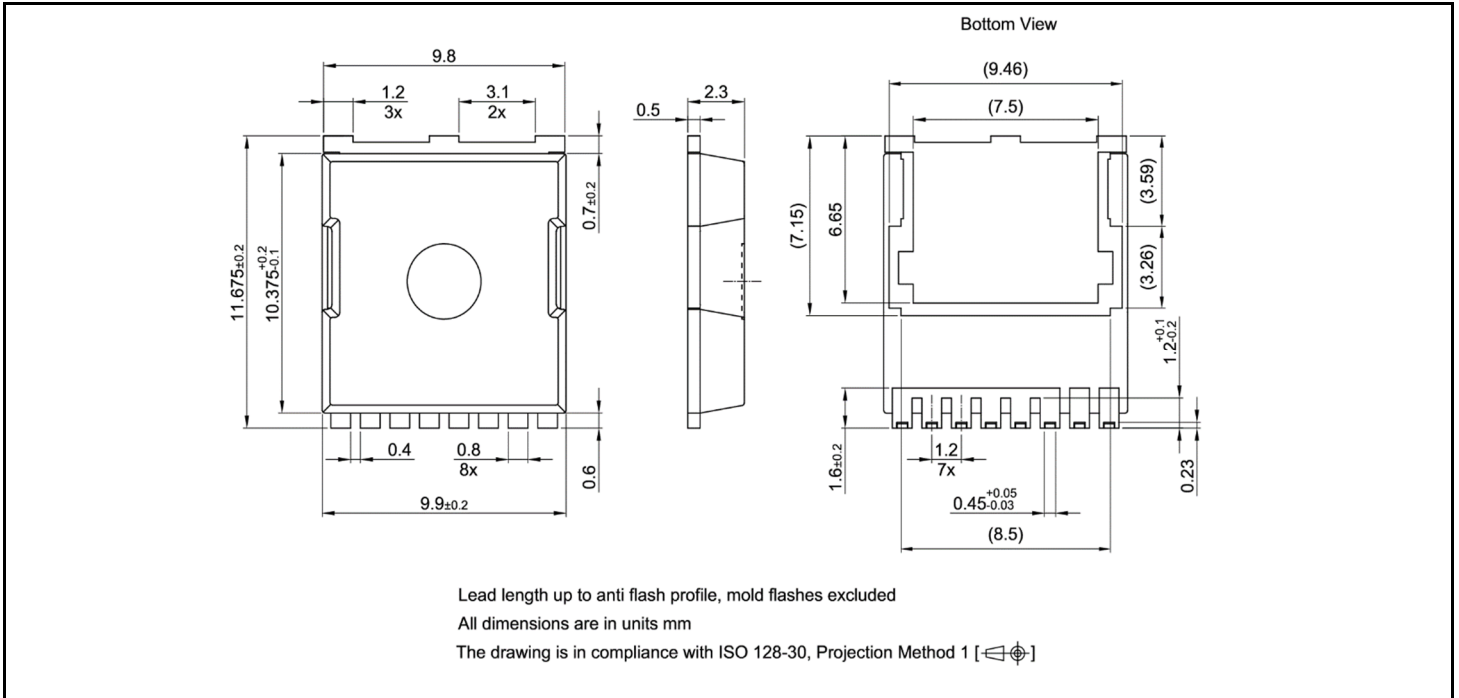
21 Typ. gate threshold voltage ONFET and LINFET



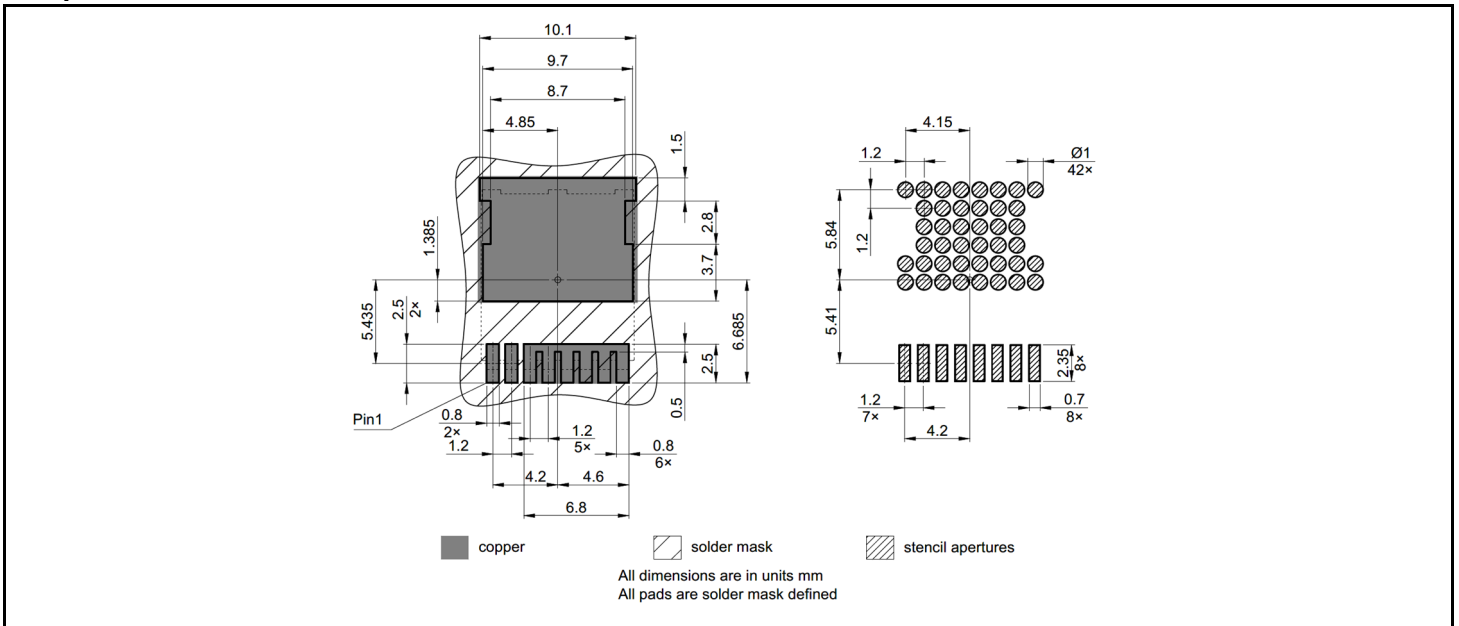
22 Max. transient thermal impedance



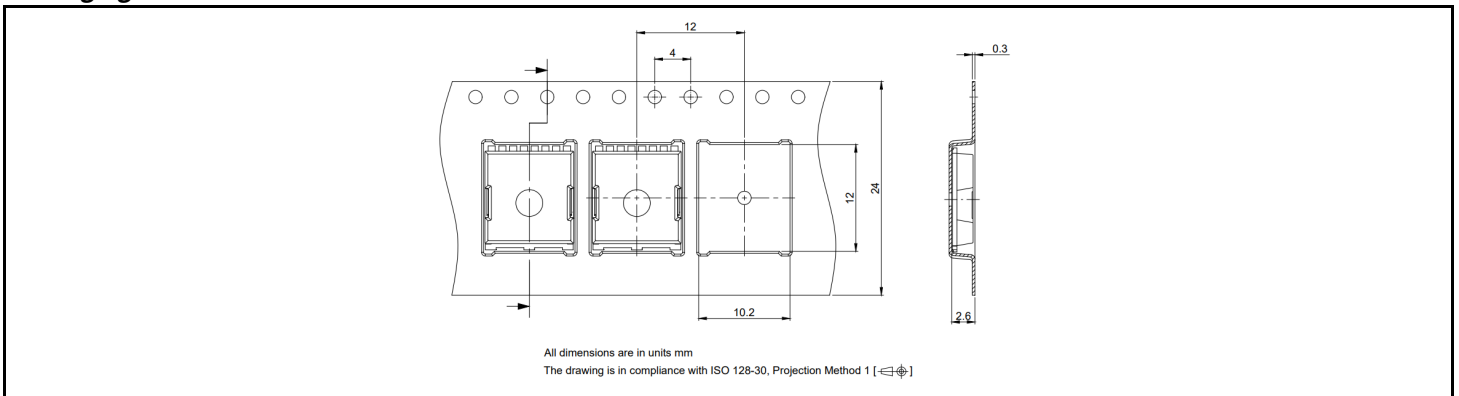
## Package outline



## Footprint



## Packaging





## Revision History

Revision	Date	Changes
Rev 1.0	2024-02-28	Final Data Sheet

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**Edition 2024-02-28**

**Published by**

**Infineon Technologies AG**

**81726 Munich, Germany**

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**Document reference**

**Z8F80541192**

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